CHAPTER 3

IMPACT OF GENERIC FLUID MILK AND DAIRY ADVERTISING ON DAIRY MARKETS: AN INDEPENDENT ANALYSIS

The Dairy Production and Stabilization Act of 1983 (Dairy Act; 7 U.S.C. 4514) and the Fluid Milk Promotion Act of 1990 (Fluid Milk Act; 7 U.S.C. 6407) require a yearly independent analysis of the effectiveness of milk industry promotion programs. These promotion programs operate to increase milk awareness and thus the sale of fluid milk and related dairy products. From 1984 to 1994, the U.S. Department of Agriculture (USDA) was responsible for the independent evaluation of the National Dairy Promotion and Research Program (Dairy Program), as authorized by the Dairy Act, and issued an annual report to Congress on the effectiveness of the Dairy Program. Beginning in 1995, the Congressional report began including third-party analyses of the effectiveness of the Dairy Program in conjunction with the National Fluid Milk Processor Promotion Program (Fluid Program) authorized by the Fluid Milk Act. While both programs utilize various types of marketing strategies to increase fluid milk and cheese consumption, this report focuses solely on media advertising impacts since advertising remains the most important marketing activity. In addition, data limitations on non-advertising promotion activities need to be addressed for future modeling purposes. The effects of fluid advertising under both programs are combined because the objectives of both programs are the same and data cannot be satisfactorily segregated to evaluate the two programs separately. An evaluation of the effectiveness of cheese advertising by the Dairy Program, however, is conducted separately.

Most economic models (including those used in past Reports to Congress) used to evaluate the effects of generic advertising programs over time measure the average impacts of various factors on demand. These "constant-parameter" models can be problematic when the time period covered is relatively long and the marketing environment has sufficiently changed. For example, the results of last year's report were based on data for the years 1975-2000, i.e., the effect of generic fluid milk and cheese advertising was measured as an average over this 26-year period. A mean-response model of generic advertising may not accurately convey the current degree of advertising effectiveness given changes in market environments, population profiles, and eating behavior over time. In addition, advertising messages have changed, conversion of state to nationally run programs has occurred, and additional groups (e.g., milk processors) have contributed to the national program since the inception of generic advertising programs.

An alternative approach to measure the impacts of advertising, given a long history of time series data, is to use a "time-varying parameter" model. These types of models measure how the impact of demand factors, including generic advertising, vary over time. In this year's report such a model is adopted and, consequently, one can examine how the effectiveness of generic fluid milk and cheese advertising has changed over time. Moreover, the model is able to identify important factors that have influenced the changes in advertising effectiveness over time. The model used is unique in its level of disaggregation of the U.S. dairy industry. For instance, the dairy industry is divided into retail, wholesale (processing), and farm markets, and the retail and wholesale markets include fluid milk and cheese separately. The model simulates market conditions with and without the Dairy and Fluid Programs.

The following summarizes the findings of the report. Copies of the complete evaluation report may be obtained from Cornell University, USDA, Dairy Management Inc., the National Dairy Promotion and Research Board, or the National Fluid Milk Processor Promotion Board.

HIGHLIGHTS

Generic fluid milk and dairy product advertising conducted under the Dairy and Fluid Programs had a major impact on dairy markets. Over the period 1997-2001, on average, the following market impacts would have occurred if the advertising under the Fluid Program had not been in effect, and advertising under the Dairy Program was equal to its level the year prior to the enactment of the national mandatory program[1]:

- Fluid milk consumption would have averaged 4.5 percent lower annually.
- Cheese consumption would have averaged 1.0 percent lower annually.
- Total consumption of milk in all dairy products would have averaged 1.9 percent, or roughly 3.6 billion pounds of milk fat equivalent, lower annually.
- The average price received by dairy farmers would have averaged 6.9 percent, or $0.96 per hundredweight, lower annually.
- Commercial milk marketings by dairy farmers would have averaged 1.9 percent lower annually.

Over the same period, the following market impacts would have occurred if the Dairy Program were not in existence but the Fluid Program were, and advertising expenditures by dairy farmers were equal to the level that existed the year prior to enactment of this program:

- Fluid milk consumption would have averaged 1.1 percent lower annually.
- Cheese consumption would have averaged 1.1 percent lower annually.
- Total milk consumption of all dairy products would have averaged 0.8 percent, or roughly 1.3 billion pounds of milk fat equivalent, lower annually.
- The average price received by dairy farmers would have averaged 1.7 percent, or $0.23 per hundredweight, lower annually.
- Commercial milk marketings by dairy farmers would have been 0.8 percent lower annually.
- The average benefit-cost ratio (BCR) for the Dairy Program was 6.26, meaning that each dollar invested in fluid milk and cheese advertising returned $6.26 in revenue to dairy farmers on average.

[1] It is important to note that there was generic milk and cheese advertising conducted by some states prior to passage of the 1983 Dairy Production Stabilization Act, which authorized the Dairy Program. As such, to measure the advertising impacts of the Dairy Program, this study simulated and compared market conditions with the Dairy Program versus market conditions reflecting advertising funding levels prior to when the Dairy Program was enacted. Throughout this report, any scenario referring to the absence of the Dairy Program reflects advertising funding at levels prior to enactment of the Dairy Program.

FACTORS AFFECTING THE DEMAND FOR FLUID MILK AND CHEESE

Because there are many factors that influence the demand for fluid milk and cheese besides advertising, an econometric model was used to identify the effects of individual factors affecting the demand for these products. The following variables were included as factors influencing per capita fluid milk demand: the Consumer Price Index (CPI) for fluid milk, the CPI for non-alcoholic beverages used as a proxy for fluid milk substitutes, per capita disposable income, the percentage of the U.S. population less than six years old, the percentage of the U.S. population that is African American, variables to capture seasonality in fluid milk demand, a trend variable to capture changes in consumer tastes for fluid milk over time, expenditures on brand fluid milk advertising, and expenditures on generic fluid milk advertising. The following variables were included as factors influencing per capita cheese demand: the CPI for cheese, the CPI for meat used as a proxy for cheese substitutes, per capita disposable income, per capita food away from home (FAFH) expenditures, the percentage of the U.S. population that is Asian/Other (specifically, non-White and non-African American); the percentage of the U.S. population between 20 and 44 years old, variables to capture seasonality in cheese demand, a trend variable to capture changes in consumer tastes for cheese over time, expenditures on brand cheese advertising, and expenditures on generic cheese advertising.

The model was estimated with national quarterly data from 1975 through 2001. To account for the impact of inflation, all prices and income were deflated. Brand and generic fluid milk and cheese advertising expenditures were deflated by the Media Cost Index. Because advertising has a carry-over effect on demand, past advertising expenditures also were included in the model as explanatory variables using a distributed-lag structure.

Unlike most previously used "constant-parameter" models that measure the average impact each of the above factors has on milk and cheese demand, the "time-varying parameter" model used in this report measures each demand factor's impact on a quarterly basis. Moreover, the model used here is able to identify what factors were most important to the variation of advertising response over time. This is advantageous since the model not only allows one to measure the magnitude of each factor on demand, but also how that magnitude has changed and what has impacted this change over time.

The relative impacts of variables affecting demand are represented with what economists call "elasticities." Elasticities measure the percentage change in per capita demand given a one percent change in one of the identified demand factors. **Table 3-1** presents the estimated elasticity values for the primary demand factors for fluid milk and cheese averaged over the most recent five-year period. For example, the price elasticity of demand for fluid milk equal to -0.136 means that a one percent increase in the real, inflation-adjusted fluid milk price decreases per capita fluid milk demand by 0.136 percent. While **Table 3-1** presents these elasticities as 5-year averages, discussion in the text and various figures that follow display how these elasticities have varied annually over time. While the principal focus of this report is on generic advertising elasticities for fluid milk and cheese, it also is important to examine the relative importance of the other factors that affect per capita demand.

Fluid Milk

Since 1997, the primary factors that have influenced per capita fluid milk demand are: (1) the percentage of the population under six years of age, (2) per capita disposable income, (3) the percentage of the population that is African American, and (4) retail fluid milk price. However, most of these elasticities have changed considerably over time. Price response for fluid milk increased relatively modestly through the first two-thirds of the 1975-2001 sample period, ranging from approximately –0.05 in the mid-1980s to –0.18 in the early 1990s (**Figure 1**). Since then, price response has decreased slightly to its current level of –0.12. This relatively modest level of price response for fluid milk is similar to other estimates in the literature.

Somewhat surprising has been fluid milk demand response to income changes over time. While average income elasticities for fluid milk remain below that for cheese (**Table 3-1**), increases in income elasticities over time for fluid milk and cheese were quite similar (**Figure 2**). Since 1997, a one percent increase in disposable income has resulted in an average 0.64 percent increase in per capita fluid milk demand. See Table 4-1.

While the youngest-age cohort in the United States still remains an important factor affecting fluid milk demand, reductions in the proportionate size of this cohort since the mid-1990s appear directly correlated with reductions in this elasticity from around 1.30 in 1994 to 0.80 currently (**Figure 3**). For every one percent decline in the proportion of the U.S. population less than six years old, there has been a 0.92 percent average decrease in per capita fluid milk demand since 1997 (**Table 3-1**).

Lower per capita fluid milk demand of African Americans relative to the rest of the population is well recognized. Since 1997, a one percent increase in the proportion of the population that is African American has resulted in an average decrease in per capita fluid milk demand of –0.24 (**Table 3-1**). A doubling in the level of response has occurred over time, ranging from approximately –0.10 early in the sample period to –0.30 in 1994-95, then rebounding to around –0.20 in 2001 (**Figure 4**).

Cheese

The primary factors influencing per capita cheese demand include: (1) per capita disposable income, (2) the percentage of the population between 20 and 44 years of age, (3) the percentage of the population that is Asian/Other, (4) retail cheese price, and (5) per capita expenditures on FAFH. As with fluid milk, cheese demand is becoming increasingly responsive to changes in per capita disposable income. Since 1997, a one percent increase in the per capita disposable income resulted in an average increase in per capital demand of 0.75 percent (**Table 3-1**). This factor has shown strong growth since the mid-1980s, but the level since the mid-1990s has been relatively constant (**Figure 2**). Even so, the relatively high income elasticities for fluid milk and cheese currently are intuitively attractive to future changes in per capita demand as real income levels continue to increase.

The retail cheese price also has an important impact on cheese demand. Since 1997, a one percent increase in the real cheese price has resulted in a 0.46 percent average decrease in cheese demand (**Table 3-1**). While price elasticities for fluid milk have been relatively constant over time, cheese price elasticities have demonstrated an increasing trend (**Figure 1**). Price elasticities for cheese since the early-1990s have been more variable but have remained between –0.40 and –0.50. The increase in price response from cheese may, in part, be due to consumers dining out more, arguably a more price-sensitive market. However, recent increases in the levels of price responsiveness also may be due to increases in average prices faced by consumers.

Both population variables included in the model (i.e., the proportion of the population between 20 and 44 years of age and the proportion of the population that is Asian/Other) had an important impact on cheese demand. Since 1997, a one percent increase in the proportion of the U.S. population between 20 and 44 years of age resulted in a 0.59 percent average increase in cheese demand (**Table 3-1**). The importance of this factor, which indicates that middle-aged people eat more cheese relative to the rest of the population, demonstrated a consistent increase during the decade of 1980s; however, since then response levels have been relatively constant (**Figure 3**). Since 1997, a one percent increase in the proportion of the Asian population resulted in a 0.56 percent average increase in cheese demand (**Table 3-1**). Changes in the level of response to this variable show slow but steady growth over the time period evaluated (**Figure 4**).

Given that approximately two-thirds of national cheese disappearance is consumed in sectors away from home, it is not surprising that per capita expenditures on FAFH is related to per capita cheese demand. Since 1997, a one-percent increase in per capita expenditures on FAFH resulted in a 0.20 percent average increase in cheese demand (**Table 3-1**). However, even though real expenditures on FAFH have been increasing over time, the level of demand response has been decreasing. Elasticities for this variable were in excess of 0.50 early in the 1975-2001 sample period, compared with 0.20 in 2001 (**Figure 5**).

Branded advertising expenditures did not significantly contribute to the explained variation in either the fluid milk or cheese demand models. While any advertising objective includes increasing sales, branded advertising efforts are heavily concentrated on gaining market share from their competitors, which may, in effect, have no impact on total sales. Branded fluid milk advertising expenditures are relatively small compared to their generic counterparts; however, cheese is just the opposite, with considerably more branded advertising expenditures. In any event, neither model exhibited a response on per capita demand that was significantly different from zero.

While branded advertising efforts did not demonstrate significant impacts on overall demand, generic advertising was positive and significant for both fluid milk and cheese demand. The time-varying advertising elasticities show substantial variation over time, with both increasing considerably since the beginning of the 1975-2001 sample period (**Figure 6**). Since 1995, however, both fluid milk and cheese generic advertising elasticities have demonstrated modest decreases.

Both products show significant increases in advertising elasticities following the inception of the Dairy Program in 1984, with each reaching their highest levels around 1994. Fluid milk generic advertising elasticities increased from 0.02 at the beginning of the sample period in 1977 to nearly 0.06 in 1994. Currently, the fluid milk generic advertising elasticity is around 0.04. Generic advertising elasticities for cheese ranged from 0.005 to 0.045 over the same time frame and are currently at levels very similar to that for fluid milk generic advertising. A similar increase in advertising response was not exhibited following the addition of advertising expenditures from the Fluid Program in 1995. This may be due, in part, to the fact that the Fluid Milk Board expenditures are combined with the Dairy Program fluid milk expenditures in the economic model, and while total fluid milk advertising expenditures have increased with the inception of the Fluid Program, Dairy Program expenditures on fluid milk have been reduced somewhat as advertising dollars were shifted to cheese advertising.

It is important to note that past constant-parameter advertising studies have consistently shown advertising elasticities for cheese demand below that for fluid milk demand. Response levels over the entire sample period clearly exhibit this characteristic as well. However, since the mid-1990s fluid milk and cheese generic advertising elasticities have been very similar. In fact, since 1997, a one percent increase in generic advertising for fluid milk resulted in an average 0.042 percent increase in per capita fluid milk demand, compared with an average elasticity for generic cheese advertising of 0.039 (**Table 3-1**).[2]

FACTORS AFFECTING GENERIC ADVERTISING EFFECTIVENESS

The model used in this study is able to measure how changes in variable levels have impacted generic advertising effectiveness over time. That is, allowing advertising response to vary over time is important and beneficial, but knowing what factors contributed to that variation, and by how much, provides valuable information for crafting future advertising strategies or altering target audiences. We can define these impacts mathematically from the time-varying parameter model specification, and we refer to them as *generic advertising response elasticities* – in essence, an elasticity of an elasticity! Specifically, the generic advertising response elasticity measures the percentage change in the generic advertising elasticity given a one percent change in the variable of interest. For example, how are generic advertising elasticities affected by changes in real income or by changes in food expenditure patterns? The signs of the generic advertising response elasticities provide useful information for product marketers in crafting future market strategies. Furthermore, by using the actual changes of the included variables, we can estimate the relative impacts of these variables on estimated changes in advertising elasticities.

[2] It is hypothesized that advertising of pizza and cheeseburgers has a positive effect on the consumption of cheese. Such variables were not included in the model due to a lack of data. Assuming pizza and cheeseburger advertising has a significantly positive effect on cheese consumption, omission of these variables could result in the impact of generic cheese advertising being somewhat overstated.

Advertising response elasticities were computed and averaged over the time period of 1997-2001 and are presented in **Table 3-2**. The relatively low standard deviations indicate that these response elasticities have been quite constant over the time period evaluated. The response elasticities do, however, differ considerably between fluid milk and cheese. Price effects were negative in both cases; however, the generic advertising response elasticity for cheese was considerably higher than that for fluid milk. The negative signs indicate that advertising is more effective during periods of lower product prices. As such, coordinating advertising efforts with price promotions would be an effective strategy to increase overall advertising response.

Increasing income levels have increased the effectiveness of both fluid milk and cheese advertising, although the effect was nearly 40% higher for cheese. The generic advertising response elasticity for income was similar in magnitude to the price effect for cheese, but considerably higher for fluid milk. The relatively large numbers and positive signs indicate that designing advertising messages targeting middle- and high-income levels would be an effective strategy to increase overall generic advertising response.

The negative response elasticity for FAFH expenditures indicates that as per capita expenditures on FAFH increase, the overall response to the generic cheese advertising message is reduced (**Table 3-2**). This may be due to the fact that while two-thirds of cheese disappearance is away from home, nearly all generic cheese advertising is focused on at-home consumption. As such, the advertising message is not effective at getting consumers to eat more cheese in the away-from-home market. As such, it is reasonable to expect that as consumers spend more of their budget away from home, the current generic cheese advertising message becomes less effective. Given the importance of cheese disappearance from the away-from-home sector, future direction of advertising campaigns specifically directed to this market may improve response to the generic message.

Both age composition advertising response elasticities for fluid milk and cheese were large and positive (**Table 3-2**). While we saw earlier that there exists a positive demand relationship between per capita cheese consumption and the proportion of the population between 20 and 44 years of age, the positive generic cheese advertising response elasticity indicates that this cohort also is more responsive to the generic advertising message. A similar relationship exists for the fluid milk category and proportion of the population under age six. It follows then that advertising strategies targeted towards these cohorts would be an effective approach to increase generic advertising response. That is, targeted messages to middle-aged consumers for cheese and to adults with young children (the implied decision makers for the youngest cohort) would be expected to increase per capita advertising response to these programs.

Finally, both race-related advertising response elasticities for fluid milk and cheese are of the same sign as their respective demand elasticities. That is, as the proportion of African Americans in the population increases, there is both a negative demand effect for fluid milk as well as decreased advertising response. Similarly, the positive demand impact of increases in the Asian population is reinforced with increases in advertising elasticities. From an advertising perspective for cheese, this is a "win-win" situation. The Asian population proportion has increased approximately 11% since 1997 and it appears that this segment of the population is more responsive to the generic advertising message.

The advertising response elasticities highlighted in **Table 3-2** indicate changes in generic advertising elasticities for marginal (i.e., small) changes in the associated variables. However, the resulting effect on changes in the generic advertising elasticity depends on both the level of the response elasticity as well as the actual change in the level of these variables over time. To evaluate the relative contributions of changes in these markets and demographic variables on recent changes in generic advertising elasiticities, we multiply the percentage changes in these variables over the time period of 1997-2001 by the associated response elasticity in **Table 3-2.** The result of this decomposition is exhibited in **Figure 7**.

Looking at the generic advertising response elasticities in this framework indicates that decreases in the proportion of the population under age six and increases in per capita income have had the largest impacts on variation in advertising response for fluid milk over the last five years (**Figure 7**). Even though the age advertising response elasticity was positive, the negative contribution of the age cohort effect is due to the fact that the proportion of the population in this cohort has decreased since 1997.

The effect of price changes over this time period on variation in generic advertising elasticities for fluid milk was about one-half of that exhibited by the other two variables, and race effects (via changes in the proportion of the African American population) were minimal. This is similar to the ranking of advertising response elasticities in **Table 3-2**; however, the actual African American race impact was reduced given its small change over the time period (i.e., around 2%). The combined negative contribution of the price, age, and race effects slightly outweigh the positive income contribution and reflects the modest reduction in the generic fluid milk advertising elasticities since 1997.

The largest contributors to the variation in generic cheese advertising response were due to increases in per capita income levels (positive) and per capita FAFH expenditures (negative), with each factor substantively negating the effect of the other (**Figure 7**). That is, advertising gains from increases in real per capita income were largely offset by increases in per capita FAFH expenditures. Race, price, and middle-aged cohort effects were also significant but well below those of the income and FAFH effects. These rankings are somewhat different than exhibited by the response elasticities in **Table 2**.

While the generic advertising response elasticities were relatively large for the price and age variables, the decomposition effects since 1997 were reduced by relatively small changes in these variables since 1997 (+4% for price, -4% for the proportion of the population age 20-44). Again, the combined negative contributions slightly outweigh the positive contributions, consistent with the overall decrease in generic cheese advertising elasticities from 1997 to 2001.

IMPACT OF THE DAIRY AND FLUID MILK ADVERTISING PROGRAMS

To evaluate recent market impacts of the Dairy and Fluid Advertising Programs, the economic model was simulated over the time period from 1999 through 2001. These two programs are complementary in that they both share a common objective to increase fluid milk sales. To accomplish this objective, both programs invest in generic fluid milk advertising, which is different from brand advertising in that the goal is to increase the total market for fluid milk rather than a specific brand's market share. In the evaluation of the programs, it is assumed that a dollar spent on fluid milk advertising by dairy farmers has the same effect on demand as a dollar spent by processors on fluid milk advertising, since both programs have an identical objective. The Dairy Program additionally has an objective to expand the market for cheese. Accordingly, part of its budget is directed to generic cheese advertising.

To examine the impacts that the two advertising programs had on the markets for fluid milk and cheese over this period, the economic model was initially simulated under two scenarios based on the level of generic advertising expenditures: (1) a baseline scenario, where generic advertising levels were equal to actual generic advertising expenditures under the two programs, and (2) a no-national program scenario, where there was no fluid milk processor sponsored advertising and dairy farmer sponsored advertising was reduced to 42 percent of actual levels to reflect the difference in assessment before and after the national program was enacted. A comparison of these two scenarios provides a measure of the combined impacts of the two programs.

Table 3-3 presents the annual averages for supply, demand, and price variables over the period 1999-2001 for the two scenarios. Generic advertising by the Dairy and Fluid Programs has had a positive impact on fluid milk consumption over this period. Specifically, fluid milk consumption would have been 4.5 percent lower had the two advertising programs not been in effect. Likewise, generic cheese advertising under the Dairy Program had a positive impact on cheese consumption, (i.e., consumption would have been 1.0 percent lower without generic advertising.) Consumption of milk used in all dairy products would have been 1.9 percent lower had these two programs not been in effect during 1999-2001.

Generic advertising by dairy farmers and milk processors also had an effect on the farm milk price and milk marketings. The simulation results indicate that the all-milk price would have been $0.96 per hundredweight lower without the generic advertising provided under the two programs. The farm milk price impacts resulted in a slight increase in farm milk marketings. That is, had there not been the two advertising programs, farm milk marketings would have been 1.9 percent lower over the 1999-2001 period due to the lower milk price.

A third scenario was subsequently simulated to measure the market impacts of the advertising program supported by the 15-cent checkoff program by dairy farmers; however, this scenario assumes that the advertising program operated by the milk processors is still in effect. As in the earlier scenario, advertising expenditures by dairy farmers were reduced to 42 percent of actual levels to reflect the situation prior to the enactment of the Dairy Program. A comparison of the third scenario with the baseline scenario gives a measure of the advertising market impacts of the current mandatory Dairy Program.

The last two columns of **Table 3-3** present the results of this scenario, which are similar to the combined fluid milk processor and dairy farmer advertising program results. Had there not been fluid milk and cheese advertising sponsored by dairy farmers, fluid milk demand would have been 1.1 percent lower, cheese demand would have been 1.1 percent lower, and total milk demand would have been 0.8 percent lower than it actually was. Advertising under the Dairy Program also had a significant impact on the farmer milk price. The simulation results indicate that the all-milk price would have been $0.23 per hundredweight lower without generic advertising by the Dairy Program. Finally, farm milk marketings would have been slightly lower (0.8 percent) in the absence of the Dairy Program.

BENEFIT-COST OF ADVERTISING BY THE DAIRY PROGRAM

One way to measure whether the benefits of a program outweigh the costs is to compute a benefit-cost ratio (BCR). A BCR can be computed as the change in net revenue due to advertising divided by the cost of advertising. While a BCR for producers can be estimated for the Dairy Program, it cannot be computed at this time for milk processors with the Fluid Program because data on packaged fluid milk wholesale prices, which is necessary in calculating processor net revenue, are proprietary information and not available.

The BCR for the Dairy Program was calculated as the change in dairy farmer net revenue (which economists call "producer surplus") due to demand enhancement from advertising under the Dairy Program divided by the advertising costs. The demand enhancement reflects increases in quantity and price as a result of the advertising program. As such, costs allocated to the enhancement represent advertising costs. Since advertising expenditures in the model only represent air-time, print space, and other direct media costs, it is necessary to incorporate expenses that reflect general administration, overhead, and advertising production costs in order to reflect the true complete costs of the advertising program supported by the checkoff. Following conversations with staff at Dairy Management Inc. (DMI) and a review of Dairy Program budgets, direct media expenditures were prorated upwards by a factor of 1.25. The results show that the average BCR for the Dairy Program was 6.26 from 1999 through 2001. This means that each dollar invested in generic fluid milk and cheese advertising by dairy farmers during the period returned $6.26, on average, in net revenue to farmers.

Another way to interpret this figure is as follows: The increase in generic advertising expenditures resulting from the enactment of the Dairy Program cost dairy producers an additional $67 million per year on average since 1999, i.e. the difference between $213 million annually under the baseline scenario and $146 million under the no-Dairy-Program scenario. The additional fluid milk and cheese advertising resulted in higher milk demand, milk prices, and profits for dairy producers nationwide. Based on the simulations conducted with the economic model, it is estimated that the average annual increase in producer surplus (reflecting changes in both revenues and costs) since 1999 due to the additional advertising under the Dairy Program was $420 million, which represents 1.8 percent of total farm cash receipts from milk marketings. Dividing $420 million by the additional advertising costs of $67 million results in the benefit cost ratio estimate of 6.26.

It should be noted that the BCR estimate here is above those estimated in previous reports that used constant parameter models. This is, in part, reflective of the higher fluid milk and cheese generic advertising elasticities estimated over the more recent time period relative to the mean-response elasticities estimated with constant parameter models over the entire sample period. In addition, previous reports evaluated a five-year time horizon and compared changes in gains in producer net revenue to the value of the entire dairy checkoff. Using a similar procedure, a constant parameter version of the above model was also estimated with results comparable to previous estimates. The goal of this report was to enhance the economic model by allowing advertising elasticities to change over time and with simulation results reflective of current market indicators to evaluate returns to the generic advertising program. The results of this approach indicate that generic advertising for fluid milk and cheese continues to be a viable and worthwhile program for milk producers.

Table 3-1. *Average elasticity values (1997-2001) for factors affecting the retail demand for fluid milk and cheese.*[a]

Factors affecting demand	Fluid Milk	Cheese
Retail price	-0.136	-0.459
Per capita income	0.645	0.753
Per capita food away from home expenditures	n.a.	0.197
Percent of population under 6 years of age	0.916	n.a.
Percent of population 20 to 44 years of age	n.a.	0.590
Percent of population African American	-0.239	n.a.
Percent of population Asian/Other	n.a.	0.557
Generic Advertising	0.041	0.039

[a] Example: A one-percent increase in the retail price of fluid milk is estimated to reduce per capita sales of fluid milk by 0.136 percent. n.a. means "not applicable."

Table 3-2*. Average Generic Advertising Response Elasticities, 1997-2001*[a]

	Fluid Milk		Cheese	
Variable	Elasticity	Std. Dev.	Elasticity	Std. Dev.
Retail price	-1.156	0.054	-6.115	0.216
Per capita income	4.416	0.114	7.331	0.189
Per capita food away from home expenditures	n.a.	n.a.	-4.718	0.203
Percent of population under 6 years of age	6.536	0.103	n.a.	n.a.
Percent of population 20 to 44 years of age	n.a.	n.a.	6.628	0.102
Percent of population African American	-1.628	0.013	n.a.	n.a.
Percent of population Asian/Other	n.a.	n.a.	2.757	0.093

[a] Interpreted as the percentage change in the long-run generic advertising elasticity for a one-percentage unit change in the associated variable.

Table 3- 3. *Simulated impacts of the Dairy and Fluid Milk Programs on selected market variables, annual average 1999-2001.*

		Baseline Scenario[a]	No National Program Scenario[b]		No Dairy Program Scenario[c]	
Market Variable	Unit	Level	Level	% Difference	Level	% Difference
Fluid Milk Demand	bil lbs	55.5	53.0	-4.5	54.9	-1.1
Cheese Demand	bil lbs MFE	68.5	67.9	-1.0	67.8	-1.1
Total Dairy Demand	bil lbs	162.3	159.2	-1.9	161.0	-0.8
Basic Formula Price	$/cwt	11.76	10.92	-7.1	11.54	-1.8
All Milk Price	$/cwt	13.87	12.91	-6.9	13.64	-1.7
Milk Marketings	bil lbs	164.1	161.0	-1.9	162.8	-0.8
Benefit-Cost Ratio[d]	$ per $1				6.26	

[a] Baseline scenario reflects the current operation of the Dairy and Fluid Milk Programs.
[b] No National Program Scenario reflects no Fluid Milk Program and Dairy Program advertising at pre-national program spending levels.
[c] No Dairy Program reflects current Fluid Milk Program and Dairy program advertising at pre-national program spending levels.
[d] Benefit-Cost ratio computed for Dairy Program only.

Figure 1. Annual Price Elasticities for Fluid Milk and Cheese

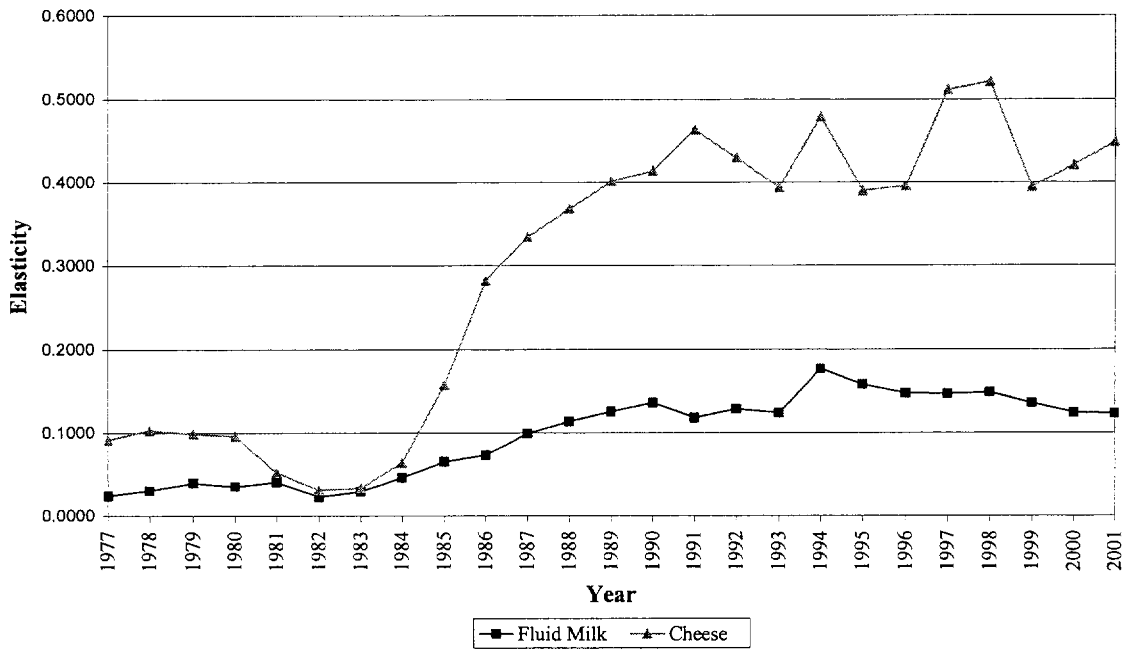


Figure 2. Annual Income Elasticities for Fluid Milk and Cheese

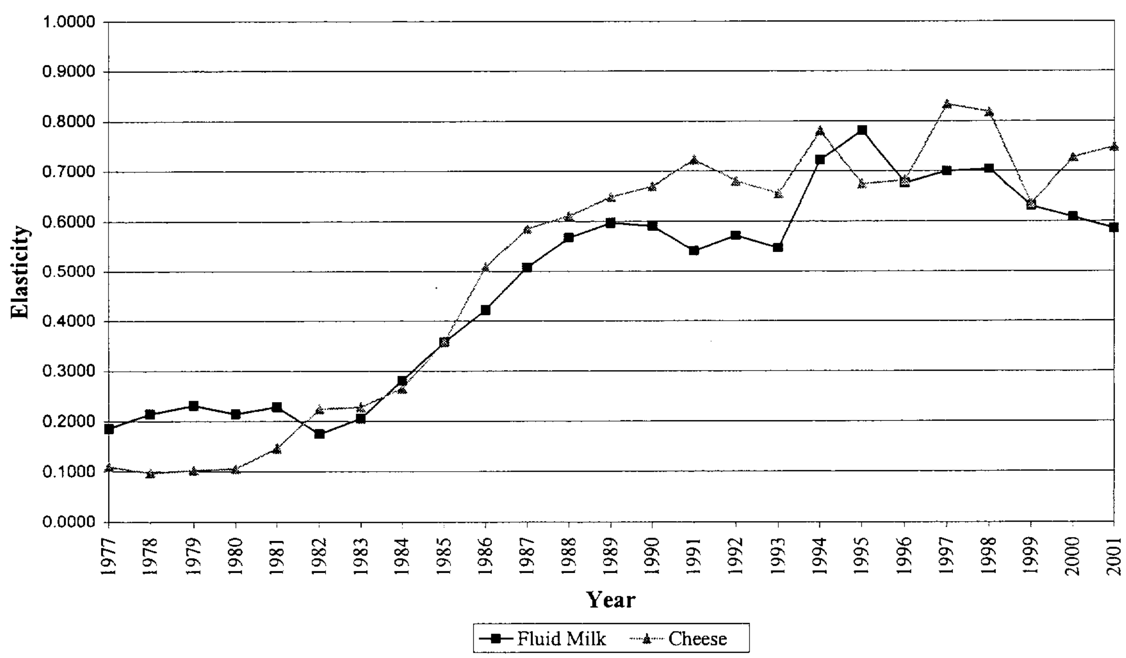


Figure 3. Annual Age Composition Elasticities for Fluid Milk and Cheese

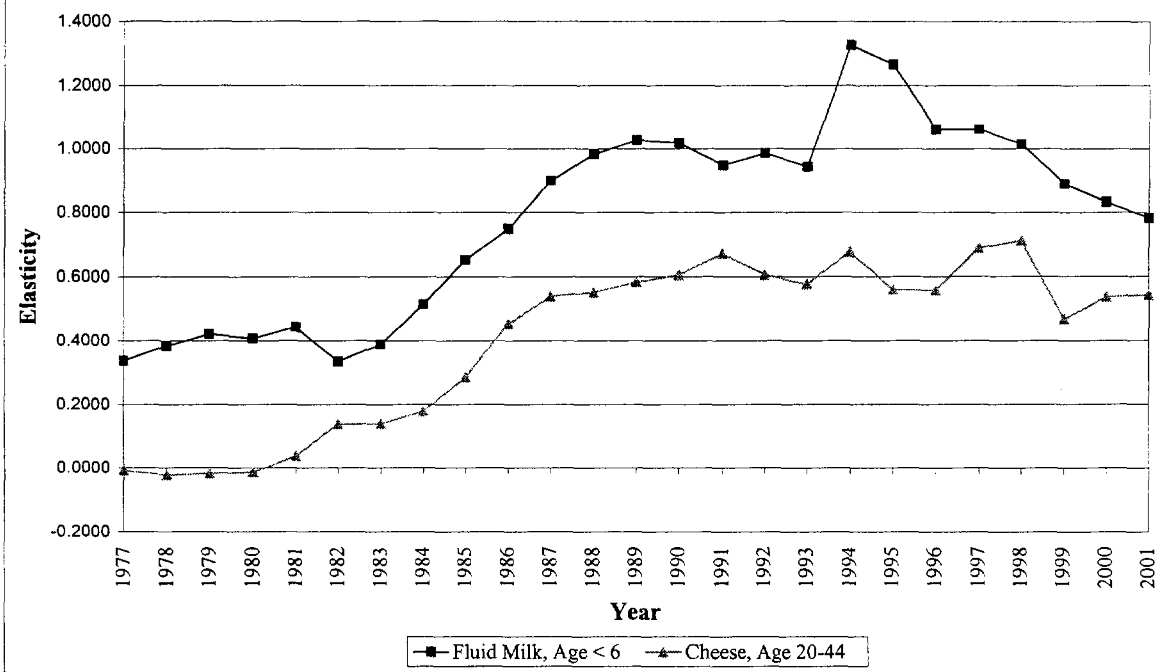


Figure 4. Annual Race Elasticities for Fluid Milk and Cheese

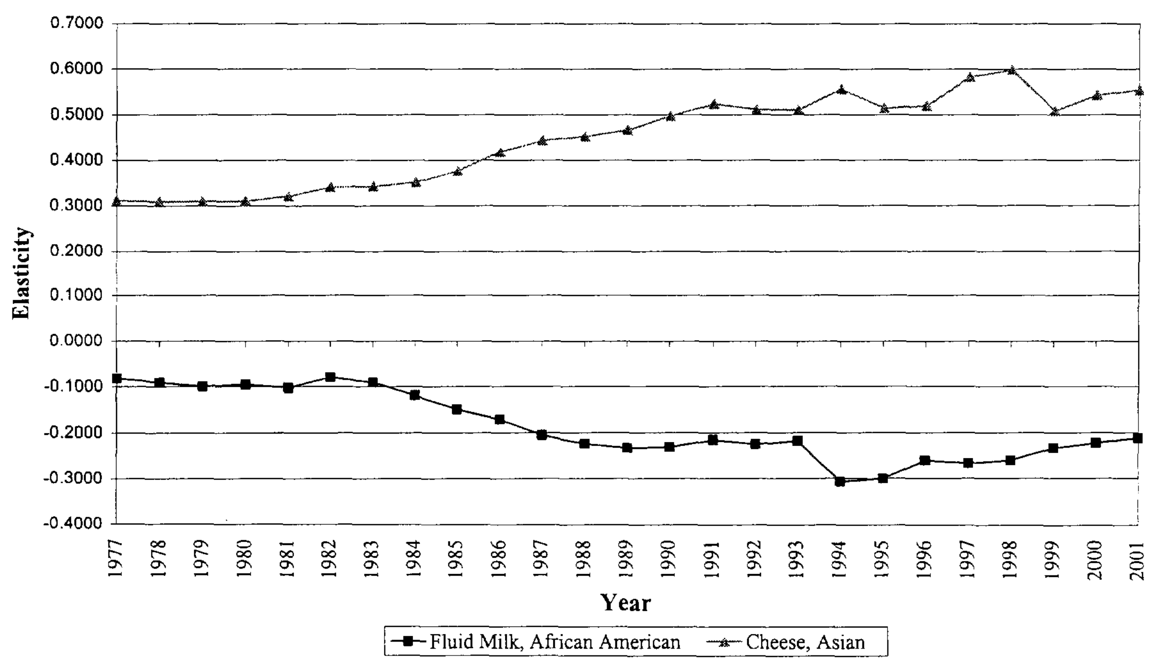


Figure 5. Annual Per Capita Food Away From Home Expenditure Elasticities for Cheese

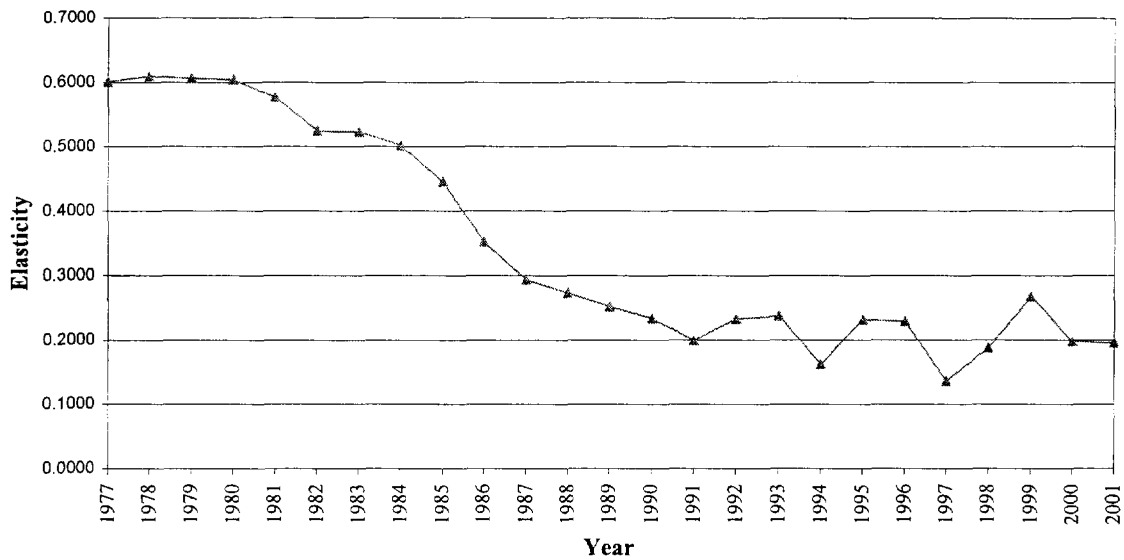


Figure 6. Annual Generic Advertising Elasticities for Fluid Milk and Cheese

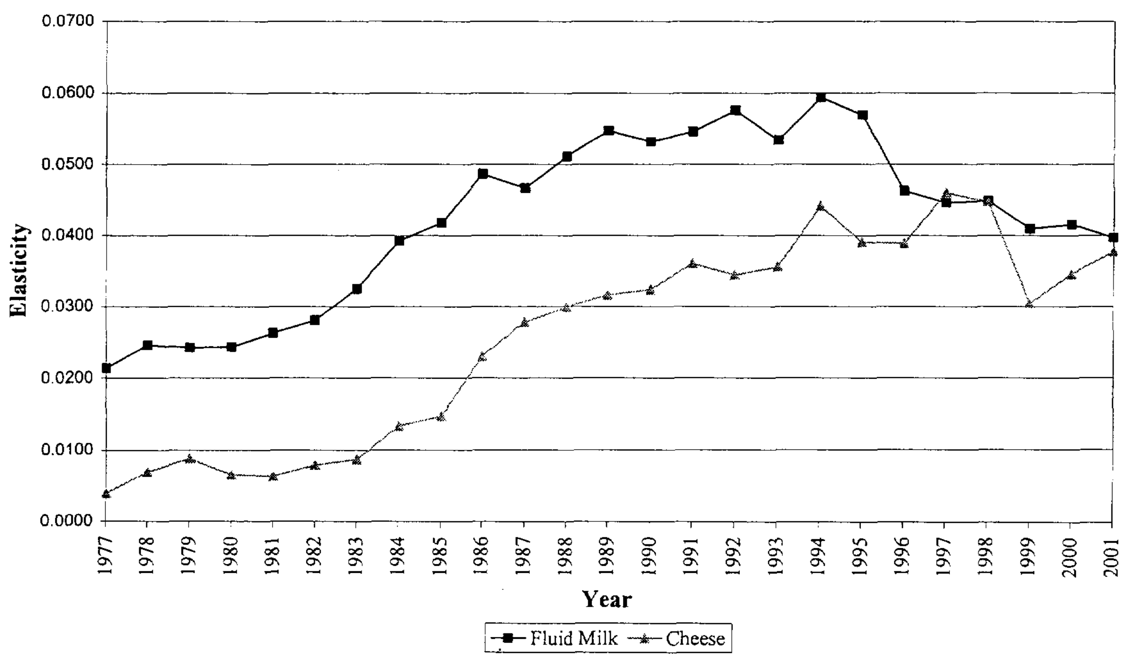
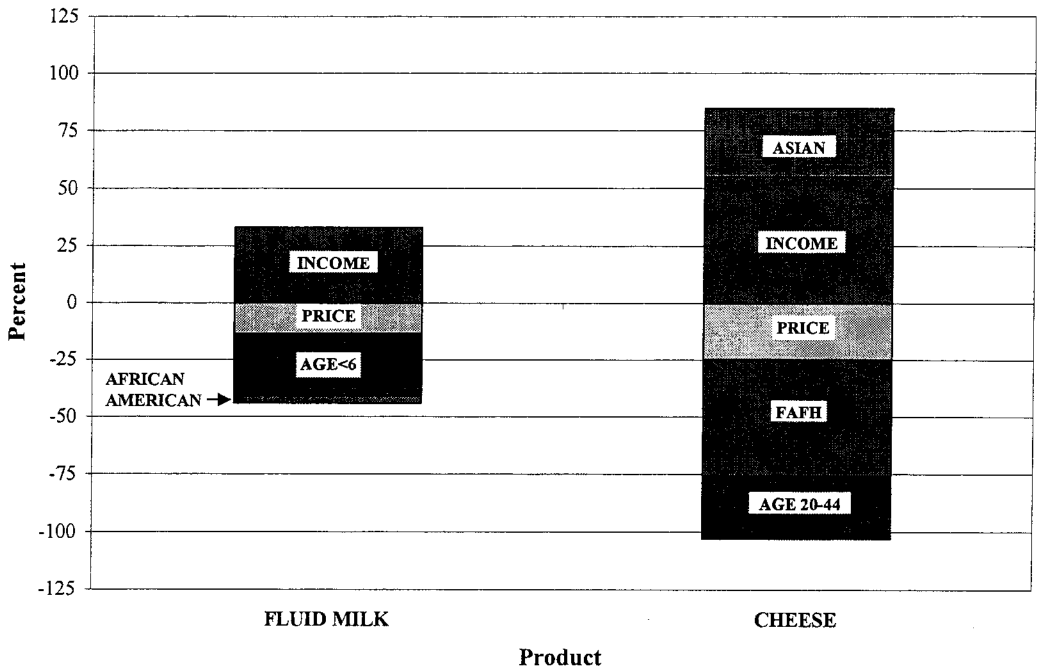


Figure 7. Generic Advertising Response Decomposition for Fluid Milk and Cheese, Percent of Total Advertising Parameter Variation 1997-2001.



Appendix. *Description of Variables Used in Econometric Model.*[a]

Variable	Description	Units	Mean[b]
	Consumption Variables		
RFDPC	Quarterly retail fluid demand per capita	lbs. MFE	49.46 (1.40)
RCDPC	Quarterly retail cheese demand per capita	lbs. MFE	60.16 (3.11)
RBDPC	Quarterly retail butter demand per capita	lbs. MFE	23.84 (2.85)
RCDPC	Quarterly retail frozen demand per capita	lbs. MFE	12.72 (1.96)
FMS	Quarterly fluid milk production	bil. lbs.	40.45 (1.47)
	Prices and Price Indices		
RFPBEV	Consumer retail price index for fresh milk and cream, deflated by retail consumer price index for nonalcoholic beverages (1982-84=100)	#	1.14 (0.05)
RCPMEAT	Consumer retail price index for cheese, deflated by consumer retail price index for meats (1982-84=100)	#	1.03 (0.04)
WFP	Wholesale fluid price index (1982-84=100)	#	1.46 (0.09)
WCP	Wholesale cheese price	$/lb.	1.39 (0.22)
MW	Basic formula price	$/cwt.	12.31 (2.13)
AMP	All milk price	$/cwt.	14.08 (1.57)
DIFF	Class I differential	$/cwt.	3.27 (1.94)
PFE	Producer energy index (1982-84=100)	#	1.02 (0.14)
	Demographic Variables		
INCPC	Per capita disposable income, deflated by the consumer retail price index for all items (1982-84=100)	$000	14.22 (0.37)
BLACK	Proportion of the population African American	#	11.95 (0.10)
ASIAN	Proportion of the population Asian	#	4.71 (0.16)
AGE5	Proportion of the population under age 6	#	6.94 (0.11)
AGE2044	Proportion of the population age 20 to 44	#	36.91 (0.57)
	Advertising Expenditures		
GFAD	Quarterly generic fluid milk advertising expenditures, deflated by Media Cost Index (2001=100)	$mil	40.74 (9.69)
GFAD_DMI	Quarterly generic fluid milk advertising expenditures, Dairy Program, deflated by Media Cost Index (2001=100)	$mil	23.31 (10.09)
GFAD_MILKPEP	Quarterly generic fluid milk advertising expenditures, Fluid Milk Program, deflated by Media Cost Index (2001=100)	$mil	17.43 (5.37)
GCAD	Quarterly generic cheese advertising expenditures, Dairy Program, deflated by Media Cost Index (2001=100)	$mil	13.47 (2.36)
BFAD	Quarterly brand fluid milk advertising expenditures, deflated by Media Cost Index (2001=100)	$mil	5.77 (2.93)
BCAD	Quarterly brand cheese advertising expenditures, deflated by Media Cost Index (2001=100)	$mil	26.43 (10.16)

[a] Quarterly dummy variables (Q1-Q3) are also included in the model to account for seasonality in demand.
[b] Mean and standard deviation computed over most recent five-year period, 1997-2001. Standard deviation in parentheses.